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Taking Flight

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EDITORIAL

Taking Flight

What does healthcare, including pharma, have in common with my profession, aerospace? The answer is quite a lot, not least of which is that both are pursuing unsustainable business trajectories.

Exactly fifty years ago I plotted a graph of the cost of new military tactical aircraft vs. time beginning with the Wright Brothers Model A through what were then the most modern fighters. To my surprise I discovered that the cost of new aircraft was following a highly predictable path. Further, with a little bit of extrapolation, I demonstrated that if we were to continue "business as usual", in the year 2054 the entire defense budget (also readily extrapolated) would purchase just one tactical aircraft! (I have often been criticized for such extrapolation, but many Washington economists extrapolate based on one data point. Furthermore, I *am* a rocket scientist!)

This conclusion was, in 1965, greeted with considerable humor by the cognoscenti. But it doesn't seem so funny today. In fact, *The Economist* recently updated my chart and concluded that we are right on my prediction—with only 39 years now remaining until the cost of that singular aircraft will equal the entire defense budget. Indeed, there are people now alive who will be around to watch it fly. . .if it does. Worse yet, its cost will equate to the entire gross domestic product (GDP) if we continue until exactly one century from today.

So what can all this have to do with healthcare, particularly pharma? This one is easy. The equation describing the cost of healthcare as a fraction of GDP over the past two-thirds of a century is also simple and goes as follows: cost, as a fraction of GDP (in percent) = 0.25 Y—487, where Y is the calendar year of interest. This very unfortunate "law" (my various rules of aerospace behavior—or misbehavior?—somehow became known as "Augustine's Laws", to my later chagrin as CEO of an aerospace company) asserts that, again following business as usual, the cost of healthcare will equal fully half of the nation's GDP in 2148 and all of it in 2348. The good news is that healthcare has a bit more time to find a better business model than does aerospace. . .but pressure is building.

Of course today's airplanes are much more capable than the Wright Brothers first military aircraft—but does that help if we will not be able to continue to afford them? So too are new drugs that for the first time offer, for example, a cure for hepatitis C—but can we afford them—at a list price of nearly $100,000 per patient?

There are most assuredly offsetting cost savings accompanying such interventions, and some studies show that it can take thousands of scientists working decades to produce a breakthrough drug, and most research to produce new pharmaceutical products fails and that which does succeed must pay its share for the failures. Furthermore, saving a human life is of unquantifiable significance. But, again, can we afford to remain on the current trajectory?

So what might be changed? At least part of the answer seems to reside in a question: Does it make sense to devote one-tenth of one percent of the GDP to healthcare basic research that in the past has produced truly remarkable results in preventing and healing illness, when it costs roughly 17 percent of the GDP to deal with the consequences of poor health using existing treatments? Furthermore, the latter figure includes only the *direct* costs of healthcare, neglecting the cost to the economy of lost productivity. It also overlooks the cost of ill health in human terms.

Another "law" can be derived that describes the historical "cost" to America of investing in fundamental biomedical research that is even more straightforward: "cost" = one-tenth of one percent of GDP. If one includes applied research, the above figure rises to about seven-tenths of one percent of GDP. Period. These seemingly universal constants have applied for decades. If the above two laws are mathematically combined, the result indicates that pursing business as usual America will be devoting proportionately less and less on research to prevent ill health relative to the growing amount that it spends on healthcare.

To the credit of pharma, the industry invests a far greater fraction of sales (about 18 percent) in R&D

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than any other industry. But there is a limit to what pharma or any industry can afford to devote to such long-term endeavors as research when America's average shareholders retain their shares for only about four months (a period that was eight years when I first entered the industrial world) and is therefore interested solely in the next quarter's return.

Biomedical research, particularly all-important basic research, is a public good, and as such the responsibility for its support falls heavily upon the federal government. But the federal government's priority for research (as a whole) is suggested by the fact that the U.S. now ranks 29th among nations in the fraction of its research that is federally funded. While many other nations are increasing their investment in research, the U.S. government is actually reducing its investment. In the case of the National Institutes of Health (NIH), that reduction has been about 22 percent in real dollars following an abortive attempt to increase biomedical research several years ago. China will almost certainly pass us within the decade in investment in research both as a fraction of GDP and in absolute terms.

As a nation we now spend eight times more on legal tobacco products and store-bought alcoholic beverages than we invest in the NIH. The issue is not one of money; the issue is how we choose to spend our money

The conclusion? If this nation is to fundamentally change the trajectory of healthcare (and, not incidentally, aerospace), two actions would provide a good start. The first is to substantially increase and sustain federal funding of research, particularly basic research. The second is to devote a greater portion of that research not only to enhancing performance or efficacy but also to decreasing the *cost* of healthcare.

So the bad news is that biomedical basic research is only one-tenth of one percent of America's GDP. But the good news is that biomedical research is only one-tenth of one percent of America's GDP. . .and therefore could be doubled without a noticeable impact on the federal budget, even if savings from newly developed preventions and cures are neglected.

Biomedical research today is in perhaps the greatest opportunity-rich era in its history. What is needed are revolutionary ideas, not marginal advances, and these have traditionally been derived through basic research. That such revolutionary ideas are "out there" is, in the case of my own field, aerospace, suggested the fact that one can now "beam" tools and parts from Earth to Earth-orbiting space stations by transmitting software at the speed of light and then manufacturing the parts aboard the station itself using 3D printers. The unimaginable can indeed become imaginable—if, of course, the necessary resources are invested.

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